

Title: The STEG Project (Statistics, Technology, Evaluation, and Graphing)

Brief Overview:

Students will conduct an investigation incorporating and analyzing simple random sampling, measures and representations of central tendency, and lines/curves of best fit to make informed conclusions.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

Number and Operations

The students will be able to understand numbers, ways of representing numbers, relationships among numbers, and number systems.

The students will be able to understand meanings of operations and how they relate to each other.

The students will be able to compute fluently and make reasonable estimates.

Algebra

The students will be able to understand patterns, relations, and functions.

The students will be able to represent and analyze mathematical situations and structures using algebraic symbols.

The students will be able to use mathematical models to represent and understand quantitative relationships.

The students will be able to analyze change in various contexts.

Data Analysis and Probability

The students will be able to formulate questions that can be answered with data and collect, organize, and display relevant data to answer them.

The students will be able to select and use appropriate statistical methods to analyze data.

The students will be able to develop and evaluate inferences and predictions that are based on data.

• Process Standards

Mathematics as Problem Solving, Reasoning and Proof, Communication, Connections, and Representation

These five process standards are threads that integrate throughout the unit, although they may not be specifically addressed in the unit. They emphasize the need to help students develop the processes that are the major means for doing mathematics, thinking about mathematics, understanding mathematics, and communicating mathematics.

Links to Maryland High School Mathematics Core Learning Units:

Functions and Algebra

• 1.1.1

The student will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.

• 1.1.2

The student will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expression.

• 1.2.1

The student will determine the equation of a line, solve linear equations, and/or describe the solutions using numbers, symbols, and/or graphs.

Data Analysis and Probability

• 3.1.1

The student will design and/or conduct an investigation that uses statistical methods to analyze data and communicate results.

• 3.1.2

The student will use the measures of central tendency and/or variability to make informed conclusions.

• 3.2.1

The student will make informed decisions and predictions based upon the results of simulations and data from research.

- **3.2.2**

The student will interpret data and/or make predictions by finding and using a line of best fit and by using a given curve of best fit.

- **3.2.3**

The student will communicate the use and misuse of statistics.

Grade/Level:

Algebra I

Duration/Length:

Two class periods, each approximately 90 minutes in length, and one partial period for the assessment.

Prerequisite Knowledge:

Students should have working knowledge of the following:

- The use of a graphing calculator to enter data and determine line/curve of best fit
- The meaning of slope, mean, mode, and median
- The use of the equation $y = mx + b$

Student Outcomes:

Students will:

- Apply random sampling to collect data.
- Calculate mean, mode, and median.
- Construct (with and/or without technology) a box-and-whisker plot.
- Interpret the effects on measures of central tendency when data is altered.
- Use data to find an equation of line/curve of best fit (with and/or without technology).
- Distinguish between interpolation and extrapolation.
- Recognize the use and misuse of data.

Materials/Resources/Printed Materials:

- Graphing calculators for students (Instructions given for the TI-83)
- Overhead graphing calculator with viewscreen
- Overhead projector
- Pencils
- Straight edge
- Two different colored strips of paper (enough for each student to have one color strip)
- 2 footballs

- 2 bath towels
- 2 water bottles
- 2 balls of yarn or string
- 2 copies of “50 yard line” posters
- Teacher Guide/Notes
- Calculator Reference Sheet
- Student Worksheets for Activity #1 and Activity #2
- Student assessment
- Teacher answer key for assessment
- Internet access (for extension only)

Development/Procedures:

The teacher will introduce the lesson by presenting the situation in the Teacher’s Guide. Students will use calculators and a “human” box-and-whisker plot to determine and analyze measures of central tendency (Activity #1). Students will be given a table of approximate figures for professional football players’ salaries to create an appropriate model to predict future salaries (Activity #2). An assessment is provided to conclude the unit.

Assessment:

Teacher will informally assess students by observing students as they work on activity sheets. A formal assessment is included consisting of items in the selected response, student produced response, brief constructed response and extended constructed response formats. Students will be asked to integrate data analysis, reasoning, and communication to support a conclusion that relates to a real-world application. A scoring rubric is also included.

Extension/Follow Up:

Students will select a career of their choice. They will use the internet to access salary information for a ten-year period. They will create a model to predict their salary when they will be 50 years old.

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THE STEG PROJECT
Statistics, Technology, Evaluation, and Graphing
Activity #1
Teacher Notes

Purpose: Students will calculate the measures of central tendency and the five-number summary to construct a “human” box-and-whisker plot to represent football player salary data. The students will also determine the relationship between the mean and median when data is skewed.

Materials for activity:

- Graphing calculator (**instructions** will be given for the TI-83)
- Overhead calculator and viewscreen
- 2 different colors of paper (enough for the class)
- 2 footballs
- 2 bath towels
- 2 water bottles
- 2 balls of yarn or string
- 2 copies of 50-yard line poster (see end of activity)
- Copies/transparencies of student worksheets
- Copies of instructions for graphing calculator
- Presentation/teaching materials (overhead markers, chalk)

I. Teacher introduction of the problem/activity

“If you were given a random sampling of the base salaries over time of professional football players, which measure of central tendency (mean, median, mode) would best represent the data?”

II. Generation of data by students using TI-83 (random number generator) (**See calculator instruction sheets for all calculator applications (CALC)**)

- A. **Distribute “THE STEG PROJECT: TI-83 INSTRUCTIONS”** worksheet. All students will generate an integer from 40 to 3,000 on their calculator to represent their salary, in thousands of dollars, if they were a pro-football player.

Note: In order to ease recording of values, these numbers within this range are generated. This value will be multiplied by 1000 to represent the salaries to the appropriate range.

- B. Instruct students to write this value on their piece of colored paper and to keep the value secret.

- C. Teacher will solicit the values from all students, and will enter these values into the calculator or have a student enter the values.

*Note: A class/group data worksheet is available (“**Salary Roster Sheet**”) use at teacher’s discretion if calculators are not available)*

1. **Keystrokes (info not on calculator sheets):**

- **STAT, enter**, enter each value, press **enter**.
2. Convert the value to thousands of dollars by multiplying the generated value by 1000.
- **Arrow** to the very top of L1, press **CLEAR**.
 - **2nd**, number **1** (for L1), **X** (multiplication symbol), **1000, enter**

L1	L2	L3	1
145			
85			
632			
2354			
1987			
25			
L1(?)=			

L1	L2	L3	1
145			
85			
632			
2354			
1987			
25			
L1=L1*1000			

L1	L2	L3	1
145000			
85000			
632000			
235400			
198700			
25000			
L1(1)=145000			

Note: For original values greater than 1000, the values in the list have been written in scientific notation. This has NOT replaced your original value, only its representation in the list.

L1	L2	L3	1
145000			
85000			
632000			
2.354E6			
1.987E5			
25000			
L1(4)=2354000			

- Instruct students to annex three zeroes to the value on their colored paper.
- Calculate the mean of the data set. (**CALC**)

III. Construct a “human” box-and-whisker plot and determine the mode.

- Students should order themselves, without talking, from lowest to highest salary (from 40 to 3,000) or (from 40,000 to 3,000,000).
- Visual Representation of box-and-whisker plot
 - Give the student representing the minimum a towel (*when you're feeling low, you throw in the towel*), and the student representing the maximum a water bottle. (*when you work really hard and perform at your best, you need some refreshment*)
 - Students will determine the lower quartile, median, and upper quartile.
 - Count in from both ends until the middle student is located. This value is the median. Give this student the 50-yard line poster. *Note: If there is an even number of students, the median is located between the two middle students. (Find the average of two student values.)*
 - Repeat this procedure from the minimum to the value below the median, and the value above the median to the maximum. *Note: If there is an even number of students, the Q1 or Q3 is located between the two middle students. (Find the average of the two student values.)* The Q1 and Q3 represent the lower and upper quartiles. The yarn/string will be used to create a “box” around the students.
 - Use results for the mean from above, round value to the nearest thousand dollars. Give this student a football.
 - Discuss results
 - Statistics obtained from the “human” box-and-whisker plot

- 1.) Mean
 - 2.) Five-number summary
 - b. Identify mode (*salary value that is repeated the most*).
 5. Analyze the relationship between the mean and median: Location of the football with relation to the 50-yard line poster.
 - a. Below $\rightarrow mean < median$,
 - b. Close to the poster $\rightarrow mean = median$,
 - c. Above $\rightarrow mean > median$
 6. Students return to their seat and check statistics with the calculator. (Teacher monitors, and performs with class.)
- IV. Determine the five-number summary and the mean using the TI-83, discussing its relationship to football salaries (**CALC**).
- A. **Distribute “Data Collection Sheet** (Page 1).” Record results in row A of data collection sheet.
 - B. Discuss results, comparing the TI-83 to the “human” box-and-whisker plot
 1. Statistics obtained from the TI-83
 - a. Mean
 - b. Five-number summary
 2. Calculator did not determine mode...why?
 3. Relationship between the mean and median (*mean < median, mean = median, or mean > median*)...why?

Complete last column of row A.
- V. Discuss questions- Part A
- A. Why are some salaries so low? so high?
 - B. Why can't all players have low/high salaries?
 - C. Would the statistics change if the player paid the lowest quits?
 - D. Would the statistics change if the player paid the highest retires or is placed on another team?
- VI. Remove extremes to show the effect of possible outliers in a data distribution.
- A. Remove minimum, then repeat step II and IV (III- *if time permits*).
 1. Edit data to remove the minimum value (**CALC**).
 2. Record results on row B on worksheet.
 3. Discussion
 - a. Comparison of trial A to trial B
 - b. What effect did removing the minimum salary have on the statistics?
 - B. Remove maximum, then repeat step II and IV (III- *if time permits*).
 1. Place the minimum data value back into the data set at the end of the list. Edit data to remove the highest value (**CALC**).
 2. Record results on row C on worksheet.
 3. Discussion
 - a. Comparison of three trials

- b. What effect did removing the maximum salary have on the statistics?
- VI. Discuss the appropriateness of results.
 - A. Accuracy of statistics: TI-83 vs. “human” box-and-whisker plot
 - B. Report of “average” or “typical” salary
 1. Which measure of central tendency is appropriate- mean, median, or mode?
 2. Explanation/justification using mathematics and results from trials B and C
- VII. Repeat lesson by dividing class in half to further demonstrate the relationships within the data distribution.
 - A. **Distribute “Data Collection Sheet (Page 2).”**
 - B. Colored papers will divide class (*could represent the AFL and NFL, with differing salaries*) One group will be group 2 and the other group 3.
 - C. Calculate the five number summary, mean, and mode and record statistics in rows D, E, F for data salaries (if generated value of 45, student should record 45,000, the true value).
Note: Students will enter their group data in L2 (group 2) and L3(group3). (Instructions when L1 is seen, students will press 2nd followed by the number 2 or 3.)
- VIII. Present statistics
 - A. Pick one student from each group to enter data into the overhead calculator or a student to record data on transparency or chalkboard.
 - B. Group 2 presents; group 3 presents.
 - C. Compare group 2 with group 3 statistics, relating back to class data statistics.
- IX. Make conclusion and show applications
 - A. Median is better measure to report “average” or “typical” salary because data could be skewed (containing outliers).
 - B. Implications of use of random data
 1. Data is “random”- there may be no correlation/relationship between the data values, other than the general stipulations
 2. No predictability for random data
 3. Random data does not account for performance
 - C. Real-world applications: Scoring/rating in the Olympics (gymnastics, aerial jumps for skiers, etc...)

Name: _____
Date: _____

The STEG Project
Activity I

Class Data (A-C)

#	Student Name	Salary (in thousands)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		
26.		
27.		
28.		
29.		
30.		
		(L1)

Group Data (D-F)

#	Student Name	Salary (in thousands)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
		(L2 or L3)

Name: _____

Date: _____

The STEG Project
Activity I

Data Collection Sheet

Class Data

TRIAL	MINIMUM	Q1	MEDIAN	Q3	MAXIMUM	MEAN	MODE	MEAN < = > MEDIAN
A. Original								
B. Remove Minimum								
C. Remove Maximum								

1. Explain the relationship between the Mean and the Median (found in the last column).
Are there any factors in the distribution of the salaries to justify this relationship? Explain.

Name: _____

Date: _____

The STEG Project
Activity I

Data Collection Sheet

Group _____ Data

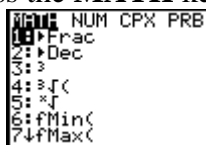
TRIAL	MINIMUM	Q1	MEDIAN	Q3	MAXIMUM	MEAN	MODE	MEAN < = > MEDIAN
D. Original								
E. Remove Minimum								
F. Remove Maximum								

1. Explain the relationship between the Mean and the Median (found in the last column).
Are there any factors in the distribution of the salaries to justify this relationship? Explain.

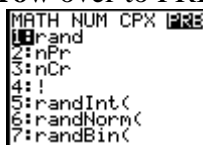
THE STEG PROJECT: TI-83 INSTRUCTIONS

GENERATE RANDOM INTEGERS

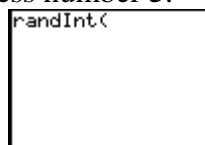
1. Press the **MATH** key, **arrow** over to PRB, press number **5**.



MATH NUM CPX PRB
1:Fract
2:Dec
3:3
4:3I
5:3J
6:fMin<
7:fMax<

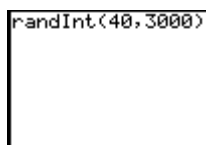


MATH NUM CPX PRB
1:rand
2:nPr
3:nCr
4:!
5:randInt<
6:randNorm<
7:randBin<

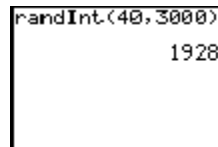


randInt<

2. Enter the values to be generated (**beginning**, **end**). Press **enter**.



randInt(40,3000)

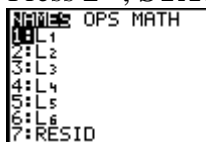


randInt(40,3000)
1928

This is a sample **random integer**.

CALCULATING THE MEAN

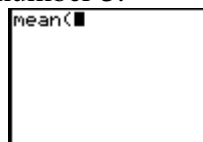
1. Press **2nd**, **STAT**, **arrow** over to MATH, number **3**.



STAT OPS MATH
1:L1
2:L2
3:L3
4:L4
5:L5
6:L6
7:RESID

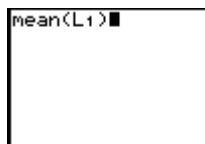


STAT OPS MATH
1:min<
2:max<
3:mean<
4:median<
5:sum<
6:prod<
7:stdDev<

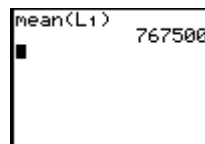


mean<

2. Select the appropriate list by pressing **2nd** and the list **number**, **)**, then **enter**.



mean(L1)



mean(L1) 767500

This is the **mean** of the list.

1. Enter data into the appropriate list by pressing **STAT**, **enter**, enter each data value followed by the **enter** key; continue until all data is entered.

L1	L2	L3	1
████████	-----	-----	
L1(1) =			

L1	L2	L3	1
45	---	---	
L1(2)=			

L1	L2	L3	1
45			
68			
247			
362			
105			
85			
L1(?)=			

- Exit the STAT mode by pressing **2nd**, **MODE**. This will display the home screen.
- Press **STAT**, **arrow** over to **CALC**, **enter**, **2nd**, list number where data is located, **enter**.

00:00 CALC TESTS 01:Edit... 02:SortA(03:SortD(04:CirList 05:SetUpEditor	00:00 EDIT TESTS 01:1-Var Stats 02:2-Var Stats 03:Med-Med 04:LinReg(ax+b) 05:QuadReg 06:CubicReg 07:QuartReg	1-Var Stats ■	1-Var Stats L1 ■	1-Var Stats $\bar{x}=152$ $\sigma_x=912$ $\bar{x}^2=216952$ $\sigma_x^2=125.1622946$ $\sigma_x=114.2570202$ $n=6$
--	---	---------------	------------------	---

- The first line represents the mean. The next four lines represent items for statistical analysis. The “n” value represents the number of values in your data set. **Arrow down** until the cursor stops.

```
1-Var Stats
n=6
minX=45
Q1=68
Med=95
Q3=247
maxX=362
```

The five-number summary is displayed.

Access data list (**STAT**, **enter**). Place cursor on data value to be deleted and press **DEL** key. Pressing **CLEAR** will not remove the data value from your set.

L1	L2	L3	1
45			
68	-----		
242			
332			
105			
85			

L1(4)=362			

L1	L2	L3	1
45			
68	-----		
242		-----	
105			
85			

L1(4)=105

The maximum value was deleted.

50

The STEG Project

Teacher's Guide for Activity 2

Purpose: The purpose of this activity is to teach students the use and /or misuse of data.

The students will use the salaries of professional football players to construct a scatter plot , to calculate the line of best fit, and to make a prediction from their findings.

Procedures:

1. Before the students begin working on this activity, the teacher should:
 - a. Review how to find the five number summary(minimum, Q1, median, Q3, and maximum), the mean, and the mode from activity 1.
 - b. Review the basic key strokes for entering information into the calculator to make a scatter plot.
 - c. Discuss with the students how to find the line of best fit and what the slope really tells you about a set of data.
 - d. Give each student an activity sheet labeled The STEG Project Activity 2 and a graphing calculator. The instruction sheet with the TI-83 calculator key-strokes(included in the packet) may be given to the students.
 - e. Discuss the activity with the students.
 - f. Instruct students that all answers should be rounded to the nearest hundredth.
2. The students will have to enter the given data into the calculator under LIST. After the students enter the data, the students need to find the five-number summary. They also need to go through the steps to get a scatter plot for the data and calculate the line of best fit. After the students have finished this process, they should make their prediction for the future and test to see if their prediction is a reasonable one. The students should then complete the activity 2 worksheet by answering the questions.
3. The students may work individually or in groups of two to complete the activity.
4. After the students have finished their work, there should be a discussion of the activity.

Name: _____

Data: _____

The STEG Project

Activity 2

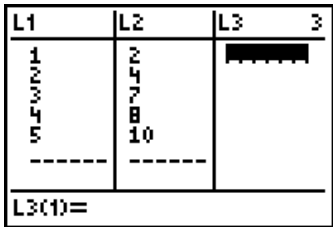
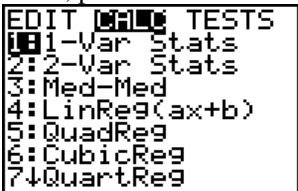
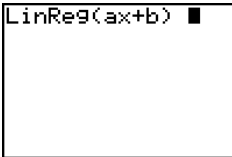
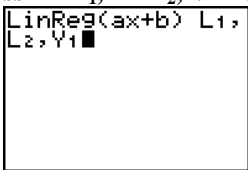
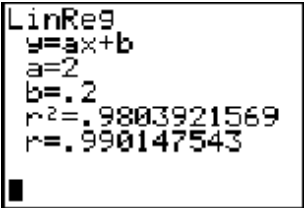
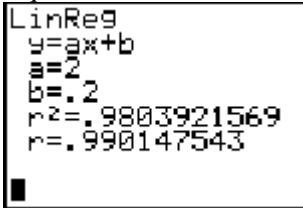
The following figures represent the median base salaries for professional football players from 1984 to 1994:

Year	Salary
1984	90,000
1985	110,000
1986	148,000
1987	150,000
1988	175,000
1989	176,000
1990	200,000
1991	245,000
1992	250,000
1993	325,000
1994	326,000

1. Find the five-number summary, (minimum, Q1, median, Q3, and the maximum), the mean, and the mode.
2. Plot the data and determine the type of curve.
3. Identify the slope of the equation and explain its meaning for this situation.
4. Based on your model, predict the median salary of a professional football player in the year 2004. Is your answer a reasonable prediction? Explain your answer using mathematics words, symbols, or both.

THE STEG PROJECT: TI-83 INSTRUCTIONS

Determining and Displaying Linear Regression Model for a Data Set

Procedure	TI-83 + Instructions
Enter the data in L ₁ and L ₂ . Use the data shown in the display.	To access the lists press STAT ENTER 
Select the LinReg model in the STAT CALC menu.	To access the STAT CALC Menu, press STAT > [] To select the LinReg model Press 4 
Enter the appropriate lists for the x -values and y – values. *On the TI-83, also enter the location for the linear regression model equation.	Press 2 nd L ₁ , 2 nd L ₂ , VARS > Y-VARS > 1 > 1 
Calculate the equation of the linear Regression model.	Press ENTER 
Display the graph of the regression equation along with the scatter plot of the data.	The equation should be at Y ₁ in the Y = screen.  Set up the scatter plot, then graph by pressing ZOOM 9

Name: _____

Date: _____

The STEG Project

Activity 2 Answer Key

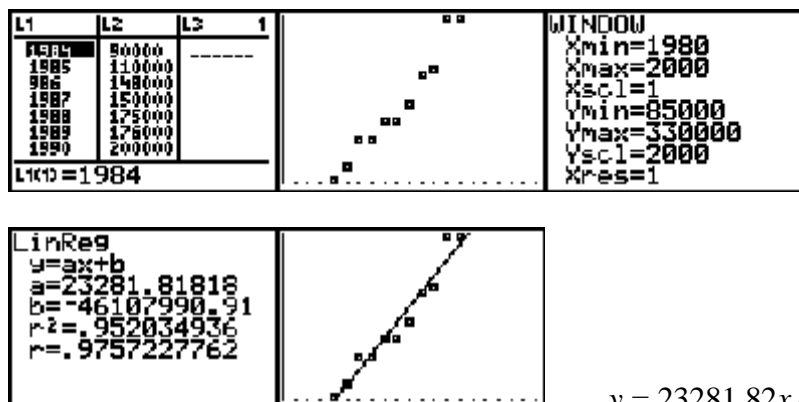
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1993	325,000
1994	326,000

- Find the five-number summary (minimum, Q1, median, Q3, and the maximum), the mean, and the mode.

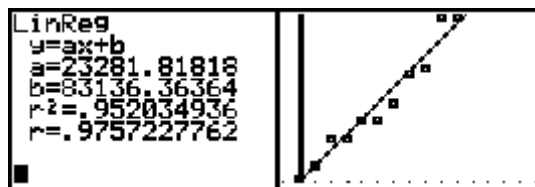
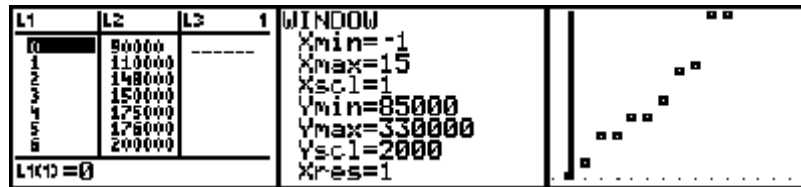
**Minimum = 90,000, Q1 = 148,000, Median = 176,000, Q3 = 250,000,
Maximum = 326,000, Mean = 199,545.45, Mode = none**

- Plot the data and determine the type of curve.



$$y = 23281.82x - 46107990.91$$

If students labeled the years since 1984 (1984 = year 0):



$$y = 23281.82x + 83136.36$$

3. Since the data appears to be linear, calculate equation for the line of best fit.

$$y = 23281.82x + 83136.36$$

4. Identify the slope of the equation and explain its meaning for this situation.

The slope is \$23,282.82. This means that each year, the football salaries go up an average of \$23,282.82.

3. Based on your model, predict the median salary of a professional football player in the year 2004. Is your answer a reasonable prediction? Explain your answer using mathematics words, symbols, or both. (Answers may vary)

The median salary for a professional football player is the year of 2004 would be \$550,780.38. No, this is not a reasonable answer because I don't believe that the salaries will increase that much. Due to injuries, some of the highest paid players may have to retire and that will have an effect on the salaries over the years. Also, new players coming in to the game will have an effect on the salaries because they may be paid a lower salary.

**The STEG Project
Assessment**

For #1-5: Frank's math test scores were 85, 75, 62, 98, 35, 80, and 75.

1. Find the mean.
2. Find the median.
3. Find the mode.
4. What happens when the score of 35 is removed from the data set?
 - a. the median changes to 77.50.
 - b. the mean changes to 79.17.
 - c. the median is less than the mean.
 - d. all of the above.
5. Using the original test scores, how are the median and mean affected when the score of 98 is removed from the data set? Explain your answer using mathematics words, symbols, or both.

For #6 -7: Sneaker City is having a big sale. The sale prices for five different style sneakers are:

Style A	\$100
Style B	\$150
Style C	\$ 85
Style D	\$100
Style E	\$225

6. What is the difference between the mean price and the median price of the sneakers?
 - a. \$ 0
 - b. \$ 32
 - c. \$ 84
 - d. \$ 232
7. What is the difference between the median price and the mode price of the sneakers?
 - a. \$ 0
 - b. \$ 32
 - c. \$ 84
 - d. \$ 232

8. Construct and label according to scale a box-and-whisker plot from the following data set representing prices (rounded to the nearest dollar) of DVD players:

Model A	199	Model F	200
Model B	252	Model G	249
Model C	300	Model H	365
Model D	89	Model I	93
Model E	154		

9. A house in Mathland is appraised every two years. The appraised values from 1990 to 2002 are listed in the table below.

YEAR	VALUE
1990	\$80,000
1992	\$87,500
1994	\$93,000
1996	\$95,000
1998	\$95,500
2000	\$100,000
2002	\$99,000

- Find the five-number summary (minimum, Q_1 , median, Q_3 , and the maximum), the mean, and the mode.
- Plot the data and determine the equation of the line of best fit.
- Identify the slope of the equation and explain its meaning for this situation.
- Based on your model, predict the appraised value of this house in the year 2018. Is your answer a reasonable prediction? Justify your answer using mathematics words, symbols, or both.

The STEG Project
Assessment Answer Sheet

Name _____
Date _____

1. _____

2. _____

3. _____

4. _____

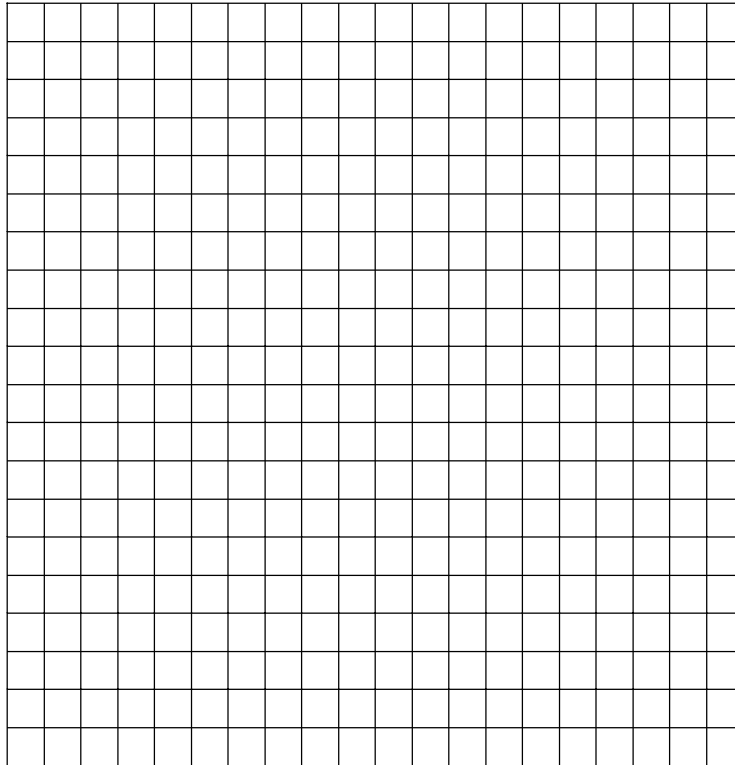
5. _____

6. _____

7. _____

8. (box-and-whisker plot)

9. Min = _____ Q_1 = _____ Median = _____
 Q_3 = _____ Max = _____
Mean = _____ Mode = _____



Equation _____

Slope _____

Appraised value in 2018 _____

**The STEG Project
Assessment Answer Sheet**

1. 72.86

2. 75

3. 75

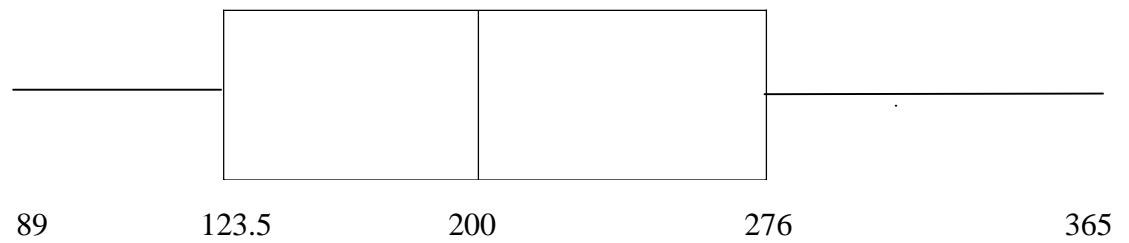
4. d

5. The mean decreases to 68.67 and the median stays at 75. When the largest number (the outlier) is removed from this data set, the new sum is smaller and it will be divided by 6 instead of 7. This will produce a smaller quotient (mean). Whereas the median stayed the same because originally there was one 75 in the middle when the data was arranged in order. When 98 was removed, there were two 75s in the middle.

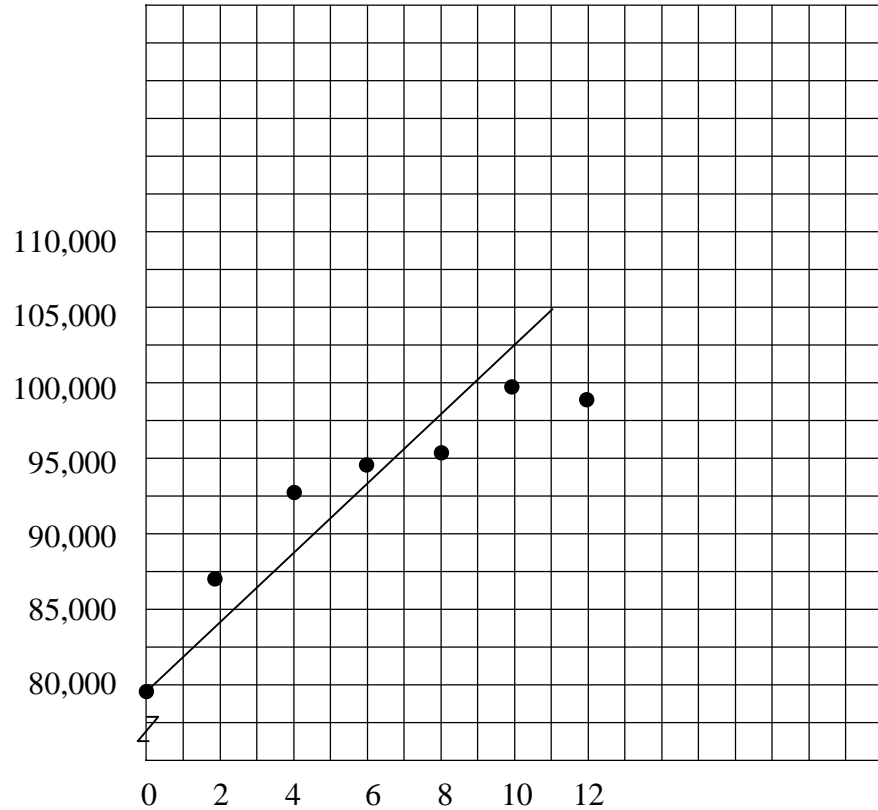
6. b

7. a

8. (box-and-whisker plot)



9. Min = \$80,000 Q_1 = \$87,500 Median = \$95,000
 Q_3 = \$99,000 Max. = \$100,000
Mean = \$92,857.14 Mode = none



Equation $y = 1508.93x + 83803.58$
(1990 is represented by 0)

OR

$y = 1508.93x - 2918964.29$
(1990 is represented by 1990)

Slope **1508.93**

The slope represents the constant rate of change of the appraised value of the home every two years.

Appraised value in 2018 **\$126,054**

Substitute 28 for x in the first equation (2018 in the second equation) and the arithmetic yields \$126,054 for the answer.

SCORING RUBRIC

- # 5 (BCR):
- 3 – The response includes correct calculations and answers for the mean and the median. The explanation is logically sound, clearly presented and fully developed. The response demonstrates a complete understanding of the problem.
 - 2 – The response includes correct calculations and answers for the mean or median. The explanation is fundamentally correct but is not well developed or complete. The response demonstrates a conceptual understanding of the problem.
 - 1 – The response is not correct for the mean or the median. The explanation reveals serious flaws in the reasoning. The response demonstrates a minimal understanding of the problem.
 - 0 – The response is completely incorrect or irrelevant. The response has no attempt of an explanation.
- # 9 (ECR)
- 4 – The response correctly calculates the five-number summary, the mean, the mode, and the slope. The representations of the data and the line of best fit are correct. The explanation and the justification are logically sound, fully developed, and clearly presented. The response demonstrates a complete understanding and analysis of the problem.
 - 3 – The response includes most of the correct calculations for the five-number summary, the mean, the mode, and the slope. The representations of the data and the line of best fit are essentially correct (contain a few minor errors of scales and/or labels). The explanation and justification are generally well developed, feasible, and support the solutions. The response demonstrates a clear understanding and analysis of the problem.
 - 2 – The response includes some of the correct calculations for the five-number summary, the mean, the mode, and the slope. The representations for the data and the line of best fit are fundamentally correct (contain several minor errors of scales and/or labels). The explanation and justification support the solutions and are plausible but not well developed or complete. The response demonstrates a conceptual understanding and analysis of the problem.

- 1 – The response has no correct calculations for the five-number summary, the mean, the mode or the slope. The representations of the data and the line of best fit are incomplete or missing. The explanation and the justification reveal serious flaws in reasoning. The response demonstrates a minimal understanding and analysis of the problem.
- 0 – The response is completely incorrect or irrelevant. There may be no response.

Suggested point values: (50 points)

- 1. 3 points
- 2. 3 points
- 3. 3 points
- 4. 3 points
- 5. 9 points
- 6. 3 points
- 7. 3 points
- 8. 7 points
- 9. 16 points